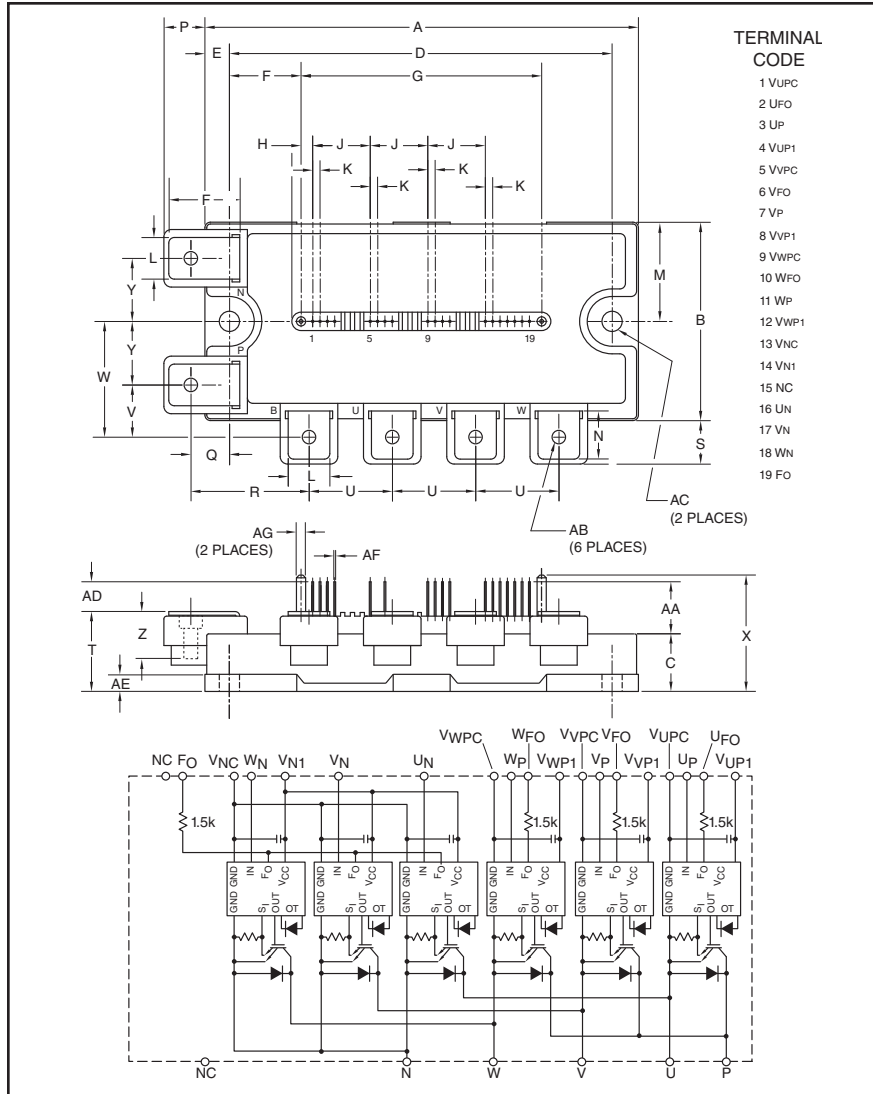
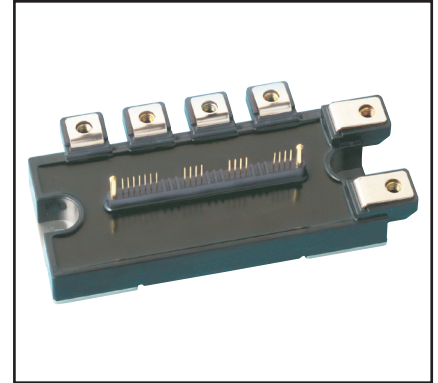


Intellimod™ L1-Series Three Phase IGBT Inverter 150 Amperes/600 Volts



TERMINAL CODE

- 1 VUPC
- 2 VFO
- 3 UP
- 4 VUP1
- 5 VVPC
- 6 VFO
- 7 VP
- 8 VVP1
- 9 VVPC
- 10 WFO
- 11 WP
- 12 VWP1
- 13 VNC
- 14 VN1
- 15 NC
- 16 UN
- 17 VN
- 18 WN
- 19 FO



Description:

Powerex Intellimod™ Intelligent Power Modules are isolated base modules designed for power switching applications operating at frequencies to 20kHz. Built-in control circuits provide optimum gate drive and protection for the IGBT and free-wheel diode power devices.

Features:

- Complete Output Power Circuit
- Gate Drive Circuit
- Protection Logic
 - Short Circuit
 - Over Temperature Using On-chip Temperature Sensing
 - Under Voltage
- Low Loss Using Full Gate CSTBT™ IGBT Chip

Applications:

- Inverters
- UPS
- Motion/Servo Control
- Power Supplies

Ordering Information:

Example: Select the complete part number from the table below -i.e. PM150CL1A060 is a 600V, 150 Ampere Intellimod™ Intelligent Power Module.

| Type | Current Rating Amperes | V _{CEs} Volts (x 10) |
|------|---------------------------|----------------------------------|
| PM | 150 | 60 |

Outline Drawing and Circuit Diagram

| Dimensions | Inches | Millimeters |
|------------|--------|-------------|
| A | 4.72 | 120.0 |
| B | 2.17 | 55.0 |
| C | 0.63 | 16.0 |
| D | 4.17 | 106.0 |
| E | 0.28 | 7.0 |
| F | 0.78 | 19.75 |
| G | 2.62 | 66.5 |
| H | 0.13 | 3.25 |
| J | 0.63 | 16.0 |
| K | 0.08 | 2.0 |
| L | 0.47 | 12.0 |
| M | 1.08 | 27.5 |
| N | 0.57 | 13.5 |
| P | 0.43 | 11.0 |
| Q | 0.42 | 10.75 |
| R | 1.29 | 32.75 |

| Dimensions | Inches | Millimeters |
|------------|----------------|----------------|
| S | 0.46 | 11.75 |
| T | 0.86+0.04/0.02 | 22.0+1.0/-0.5 |
| U | 0.91 | 23.0 |
| V | 0.57 | 14.5 |
| W | 1.26 | 32.0 |
| X | 1.24 | 31.5 |
| Y | 0.69 | 17.5 |
| Z | | Screw Depth 12 |
| AA | 0.51 | 13.0 |
| AB | M5 Metric | M5 |
| AC | 0.22 Dia. | 5.5 Dia. |
| AD | 0.28 | 7.0 |
| AE | 0.12 | 3.0 |
| AF | 0.02 Sq. | 0.5 Sq. |
| AG | 0.10 Dia. | 2.5 Dia. |



Powerex, Inc., 173 Pavilion Lane, Youngwood, Pennsylvania 15697 (724) 925-7272 www.pwr.com

PM150CL1A060
Intellimod™ L1-Series
Three Phase IGBT Inverter
 150 Amperes/600 Volts

Absolute Maximum Ratings, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | PM150CL1A060 | Units |
|--|------------------------|--------------|------------------|
| Power Device Junction Temperature | T_j | -20 to 150 | $^\circ\text{C}$ |
| Storage Temperature | T_{stg} | -40 to 125 | $^\circ\text{C}$ |
| Mounting Torque, M5 Mounting Screws | — | 31 | in-lb |
| Mounting Torque, M5 Main Terminal Screws | — | 31 | in-lb |
| Module Weight (Typical) | — | 380 | Grams |
| Supply Voltage, Surge (Applied between P - N) | $V_{\text{CC(surge)}}$ | 500 | Volts |
| Supply Voltage Protected by Short Circuit Protection Capability* | $V_{\text{CC(prot.)}}$ | 400 | Volts |
| Isolation Voltage, AC 1 minute, 60Hz Sinusoidal | V_{ISO} | 2500 | Volts |

IGBT Inverter Sector

| | | | |
|--|---------------------|-----|---------|
| Collector-Emitter Voltage ($V_D = 15\text{V}$, $V_{\text{CIN}} = 15\text{V}$) | V_{CES} | 600 | Volts |
| Collector Current ($T_C = 25^\circ\text{C}$) (Note 1) | $\pm I_C$ | 150 | Amperes |
| Peak Collector Current ($T_C = 25^\circ\text{C}$) | $\pm I_{\text{CP}}$ | 300 | Amperes |
| Collector Dissipation ($T_C = 25^\circ\text{C}$) (Note 1) | P_C | 500 | Watts |

Control Sector

| | | | |
|--|------------------|----|-------|
| Supply Voltage (Applied between $V_{\text{UP1}}-V_{\text{UPC}}$, $V_{\text{VP1}}-V_{\text{VPC}}$, $V_{\text{WP1}}-V_{\text{WPC}}$, $V_{\text{N1}}-V_{\text{NC}}$) | V_D | 20 | Volts |
| Input Voltage (Applied between U_P-V_{UPC} , V_P-V_{VPC} , W_P-V_{WPC} , $U_N-V_N-V_{\text{NC}}$) | V_{CIN} | 20 | Volts |
| Fault Output Supply Voltage (Applied between $U_{\text{FO}}-V_{\text{UPC}}$, $V_{\text{FO}}-V_{\text{VPC}}$, $W_{\text{FO}}-V_{\text{WPC}}$, F_O-V_{NC}) | V_{FO} | 20 | Volts |
| Fault Output Current (Sink Current at U_{FO} , V_{FO} , W_{FO} , F_O Terminals) | I_{FO} | 20 | mA |

Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--------------------------------------|----------------------|--|------|------|------|---------------|
| Collector-Emitter Saturation Voltage | $V_{\text{CE(sat)}}$ | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0\text{V}$, $I_C = 150\text{A}$, $T_j = 25^\circ\text{C}$ | — | 1.75 | 2.35 | Volts |
| | | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0\text{V}$, $I_C = 150\text{A}$, $T_j = 125^\circ\text{C}$ | — | 1.75 | 2.35 | Volts |
| Diode Forward Voltage | V_{EC} | $-I_C = 150\text{A}$, $V_{\text{CIN}} = 15\text{V}$, $V_D = 15\text{V}$ | — | 1.7 | 2.8 | Volts |
| Inductive Load Switching Times | t_{on} | | 0.3 | 0.8 | 2.0 | μs |
| | t_{rr} | $V_D = 15\text{V}$, $V_{\text{CIN}} = 0 \leftrightarrow 15\text{V}$ | — | 0.4 | 0.8 | μs |
| | $t_{\text{C(on)}}$ | $V_{\text{CC}} = 300\text{V}$, $I_C = 150\text{A}$ | — | 0.4 | 1.0 | μs |
| | t_{off} | $T_j = 125^\circ\text{C}$ | — | 1.0 | 2.3 | μs |
| | $t_{\text{C(off)}}$ | | — | 0.3 | 1.0 | μs |
| Collector-Emitter Cutoff Current | I_{CES} | $V_{\text{CE}} = V_{\text{CES}}$, $V_D = 15\text{V}$, $T_j = 25^\circ\text{C}$ | — | — | 1.0 | mA |
| | | $V_{\text{CE}} = V_{\text{CES}}$, $V_D = 15\text{V}$, $T_j = 125^\circ\text{C}$ | — | — | 10 | mA |

* $V_D = 13.5 \sim 16.5\text{V}$, Inverter Part, $T_j = 125^\circ\text{C}$

PM150CL1A060
Intellimod™ L1-Series
Three Phase IGBT Inverter
 150 Amperes/600 Volts

Electrical and Mechanical Characteristics, $T_j = 25^\circ\text{C}$ unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|--|---------------|---|------|------|------|------------------|
| Control Sector | | | | | | |
| Circuit Current | I_D | $V_D = 15\text{V}, V_{CIN} = 15\text{V}, V_{N1}-V_{NC}$ | — | 6 | 12 | mA |
| | | $V_D = 15\text{V}, V_{CIN} = 15\text{V}, V_{*P1}-V_{*PC}$ | — | 2 | 4 | mA |
| Input ON Threshold Voltage | $V_{th(on)}$ | Applied between U_P-V_{UPC} , | 1.2 | 1.5 | 1.8 | Volts |
| Input OFF Threshold Voltage | $V_{th(off)}$ | $V_P-V_{VPC}, W_P-V_{WPC}, U_N-V_N, W_N-V_{NC}$ | 1.7 | 2.0 | 2.3 | Volts |
| Short Circuit Trip Level | SC | $-20^\circ\text{C} \leq T_j \leq 125^\circ\text{C}, V_D = 15\text{V}$ | 300 | — | — | Amperes |
| Short Circuit Current Delay Time | $t_{off(SC)}$ | $V_D = 15\text{V}$ | — | 0.2 | — | μs |
| Over Temperature Protection (Detect T_j of IGBT Chip) | OT | Trip Level | 135 | — | — | $^\circ\text{C}$ |
| | $OT_{(hys)}$ | Hysteresis Level | — | 20 | — | $^\circ\text{C}$ |
| Supply Circuit Under-voltage Protection ($-20 \leq T_j \leq 125^\circ\text{C}$) | UV | Trip Level | 11.5 | 12.0 | 12.5 | Volts |
| | UV_R | Reset Level | — | 12.5 | — | Volts |
| Fault Output Current* | $I_{FO(H)}$ | $V_D = 15\text{V}, V_{CIN} = 15\text{V}$ | — | — | 0.01 | mA |
| | $I_{FO(L)}$ | $V_D = 15\text{V}, V_{CIN} = 15\text{V}$ | — | 10 | 15 | mA |
| Fault Output Pulse Width* | t_{FO} | $V_D = 15\text{V}$ | 1.0 | 1.8 | — | ms |

Thermal Characteristics

| Characteristic | Symbol | Condition | Min. | Typ. | Max. | Units |
|-------------------------------------|----------------|--|------|------|-------|-----------------------|
| Junction to Case Thermal Resistance | $R_{th(j-c)Q}$ | IGBT (Per 1 Element) (Note 1) | — | — | 0.25 | $^\circ\text{C/Watt}$ |
| | $R_{th(j-c)D}$ | FWDi (Per 1 Element) (Note 1) | — | — | 0.41 | $^\circ\text{C/Watt}$ |
| Contact Thermal Resistance | $R_{th(c-f)}$ | Case to Fin Per Module, Thermal Grease Applied (Note 1) | — | — | 0.038 | $^\circ\text{C/Watt}$ |

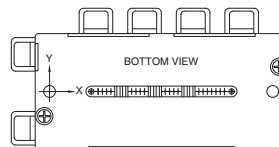
Recommended Conditions for Use

| Characteristic | Symbol | Condition | Value | Units |
|---------------------------------|----------------|--|----------------|---------------|
| Supply Voltage | V_{CC} | Applied across P-N Terminals | ≤ 400 | Volts |
| Control Supply Voltage** | V_D | Applied between $V_{UP1}-V_{UPC}$, $V_{VP1}-V_{VPC}, V_{WP1}-V_{WPC}, V_{N1}-V_{NC}$ | 15.0 ± 1.5 | Volts |
| Input ON Voltage | $V_{CIN(on)}$ | Applied between U_P-V_{UPC} , | ≤ 0.8 | Volts |
| Input OFF Voltage | $V_{CIN(off)}$ | $V_P-V_{VPC}, W_P-V_{WPC}, U_N-V_N, W_N-V_{NC}$ | ≥ 9.0 | Volts |
| PWM Input Frequency | f_{PWM} | — | ≤ 20 | kHz |
| Arm Shoot-through Blocking Time | t_{DEAD} | Input Signal | ≥ 2.0 | μs |

*Fault output is given only when the internal SC, OT and UV protections schemes of either upper or lower arm device operates to protect it.

** With ripple satisfying the following conditions: dv/dt swing $\leq \pm 5\text{V}/\mu\text{s}$, Variation $\leq 2\text{V}$ peak to peak.

Note 1: T_C (under the chip) Measurement Point

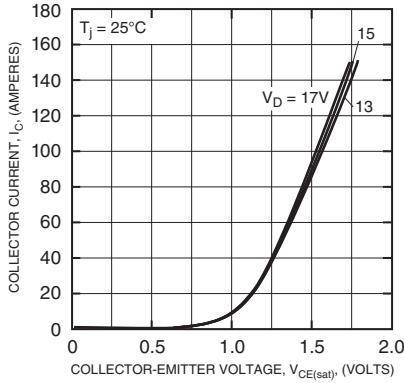


| Arm \ Axis | UP | | VP | | WP | | UN | | VN | | WN | |
|------------|------|------|------|------|------|------|------|------|------|------|------|------|
| | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi | IGBT | FWDi |
| X | 27.8 | 27.8 | 65.5 | 65.5 | 87.5 | 87.5 | 38.8 | 38.8 | 54.5 | 54.5 | 76.5 | 76.5 |
| Y | -8.4 | 1.6 | -8.4 | -0.2 | -8.4 | -0.2 | 8.0 | -0.4 | 8.0 | -0.4 | 8.0 | -0.4 |

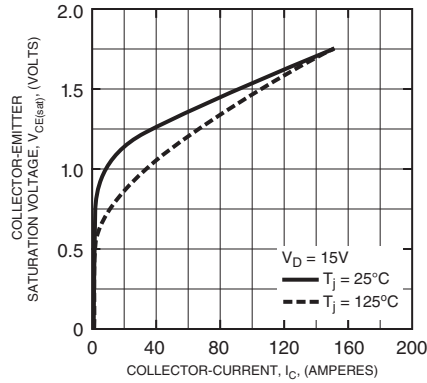


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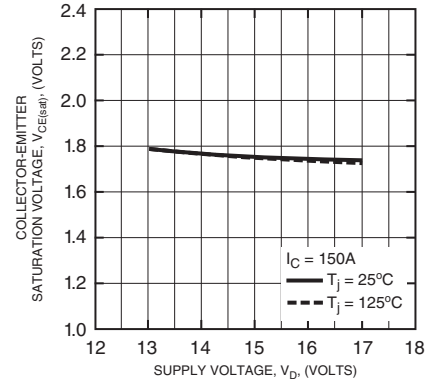
OUTPUT CHARACTERISTICS (TYPICAL)



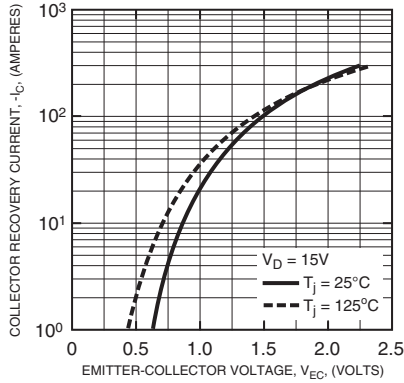
COLLECTOR-EMITTER SATURATION VOLTAGE CHARACTERISTICS (TYPICAL)



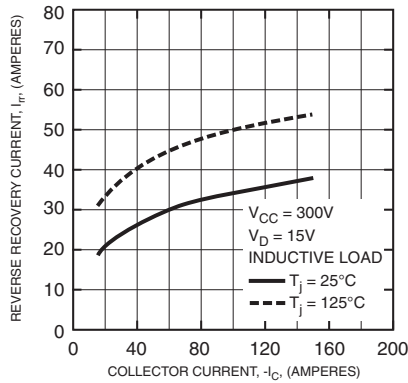
COLLECTOR-EMITTER SATURATION VOLTAGE VS. SUPPLY VOLTAGE CHARACTERISTICS (TYPICAL)



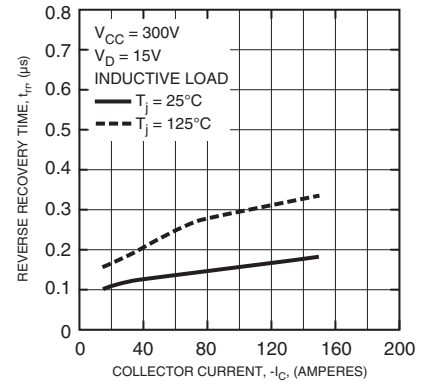
FREE-WHEEL DIODE FORWARD CHARACTERISTICS (TYPICAL)



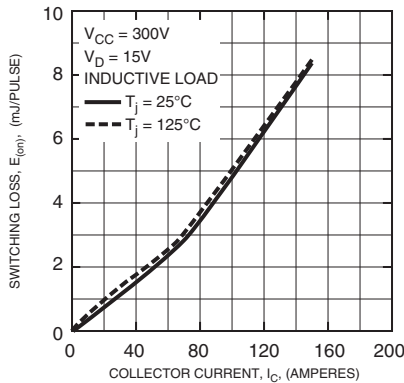
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



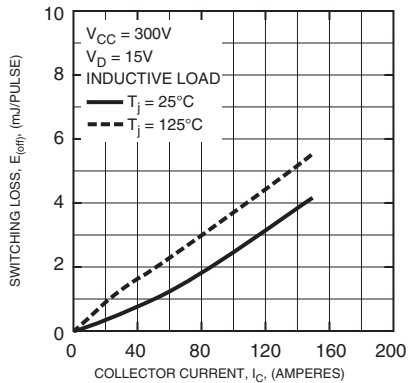
REVERSE RECOVERY CHARACTERISTICS (TYPICAL)



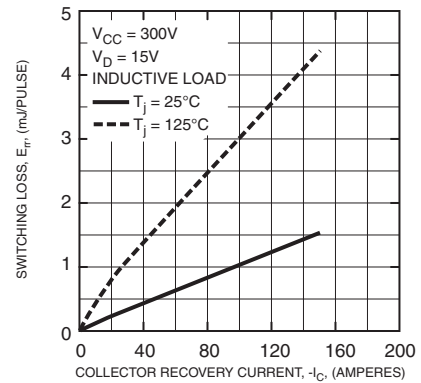
SWITCHING LOSS (ON) VS. COLLECTOR CURRENT (TYPICAL)



SWITCHING LOSS (OFF) VS. COLLECTOR CURRENT (TYPICAL)



SWITCHING RECOVERY LOSS CHARACTERISTICS (TYPICAL)



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